INDEX

A

Absolute zero, 57. Accidental oil fuel fires, 158. Acids, 128. Addition of decimals, 4. of fractions or mixed numbers. 3. and disadvan-Advantages tages of injectors, 127. of turbines, 224. Air for atomizing oil fuels, Steam and, 84. in oil burning, Excess of, Mixtures of oil spray and, pump, Pounding in, 214. required for combustion, 77. Allegheny, Pa., license law, 252. Angles or arcs, Measures of, 42. Anthracite coal, 79. Apparent cut-off, 183. slip, 231. Approximate mean effective pressure, 190. Arcs, Measures of angles or, 42 Area of chimney, 110. of safety valve, 115. Areas, Irregular, 35. of circles, Table of circumferences and, 38. Arrangement of piping, 122. Atlanta, Ga., license law, 252. Atomic weight, 55. weights of elements, Table of, 55. Atomization of oil, 83. Attachment of indicator, 175. of indicator cord, 180.

Automatic injectors, 123

Axially expanded pitch, 234. Axle, Wheel and, 66.

B

Bagasse, 81. Baltimore, Md., license law. 253.Banking fires, 164. Barrel calorimeter, 97. Bearing, Refitting cut, 216, Bearings, Brass-bound, 210. Danger of increasing heating of, 215. Dangerous heating of, 216. Effects of external heat on, Grit in, 220. Hot, 215. Lubrication of turbine, 228. Newly fitted, 217. Oils squeezed out of, 220. Remedies for increasing heating of, 215. Running engine with hot, Bed plate, Springing of, 222. Belt pulleys, 66. Belting, 69. Belts, Horsepower of, 70. Lacing of, 72. Sag of, 69. Speed of, 70. Bends, Expansion, 121. Bituminous coal, 80. Blade area, 237. area, Developed, 234. area, Helicoidal, 234. Blades, Clearance of turbine, 225. Erosion of turbine, 226. Stripping of turbine, 226. Blow-off, Bottom, 119. -off cocks and valves, 119.

Blow-off, Inspection of water gauge and, 170. -off pipe, Protection of, 119. Blowing down, 165. Boiler efficiency, 144. 254.explosions, 170. feed, Equalizing the, 148. feeding, 123. fittings, 113. horsepower, Standard of, 141. inspection, 165. inspection, External, 165. inspection, Internal, 167. management, 145. piping, 120. Preparations for shutting down a, 163. Causes test, Hydrostatic, 169. trials, 140. tubes, Dimensions of iron, 53. tubes. Dimensions of steel. **52**. Boilers, Connecting, 1.17. Filling, 145. Steam, 103. Use of zinc in, 134. Bottom blow-off, 119. Brake horsepower, 191. horsepower, Calculation of, 200. horsepower, Data for, 199. Prony, 196. pulleys, Cooling of, 198 Rope, 198. Brass and copper tubes, Table of weight of, 49. -bound bearings, 210. Brasses and journals, Cut. 218. Imperfectly fitted, 218. Loose, 210. pinching journal, Edges of, 218. Reversal of pressure on, 213. too long, 222. too loose, 217. too tight, 217. Warped and cracked, 218. Brick chimneys, 109. 123. Bridge wall, 103.

British thermal unit, 58. Broken piston packing, 21° Brumbo pulley, 178. Buffalo, N. Y., license law.

Burner, Shutting down oil fuel, 158.

Burners, Location of oil, 151. Calculating indicated horse-power, 192. Calculation of brake horsepower, 200. Calculations, Signs used in, 1. Calorific value of fuels, 78. value of oil fuels, 83. Calorimeter, Barrel, 97. remedies and pounding of engines, 210. Carbonate of lime, 127. Centrifugal force, 63. Chemical compounds, Table of common names of, 56. formulas, 55. symbols, 55. Chemistry, 54. Chicago, Ill., license law, 255. Chimney, Area of, 110. Form of, 109. foundations, 109. Height of, 110. Chimneys, 108. Brick, 109. Iron and steel, 109. Table of sizes of, 112. Chloride of magnesium, 128. of sodium, 128. Circle, 36. Circles. Table of circumferences and areas of, 38. Circular ring, 37.

Circulating pump, Pounding in, 214.

Circumferences and areas of circles, Table of, 38.

Cities having license laws, States and, 244. Classes of coal, 79.

Classification injectors. ot

Cleaning fires, 149.

Clearance, 182. Effects of, 182. of turbine blades, 225. Coal, Anthracite, 79. Bituminous, 80. Classes of, 79. consumption to speed, Relation of, 212. Maximum combustion rate of, 111. Semianthracite, 80. Semibituminous, 80. Cocks and valves, Blow-off, 119. Coefficients of linear expansion, 57. Coke, 81. Combination of pulleys, 65. Combustion, 76. Air required for, 77. Incomplete, 78. rate of coal, Maximum, 111. Common fractions, 2. Comparison of turbines and engines, 225. Composition of crude oil, 82. Compound engine, Starting and stopping Corliss, 210. engines, Horsepower of, 194. slide-valve engine, Starting, 207. slide-valve engine, Stopping, 209. Compounds, 54. Table of common names of chemical, 56. Condenser, Injection water for jet, 203. Condensers, Cooling water for surface, 202. Surface, 200. Types of, 200. Condensing slide-valve engine, Starting, 206. slide-valve engine, Stopping, 206. Connecting boilers, 147. Connection of steam gauge, 118. Construction of oil tanks, 153.

Cooling of brake pulleys, water for surface condensers, 202. Copper tubes. Table of weight of brass and, 49. Corliss engine, Starting and stopping compound, 210. Starting engine, simple, 207. Stopping engine, simple, 207. Corrosion and incrustation. 127. External, 131. Internal, 130. Prevention of incrustation and, 133. Uniform, 130. Coverings, Pipe, 121. Cracked brasses, Warped and, Crosshead, Pounding at, 213. Crude oil, Composition of, 82. Cube roots, 6. Cubes. 9. Cubic measures, 42. Cut brasses and journals, 218. -off, Apparent, 183. -off, Real, 183. Cylinder, 36. heads, Piston striking, 212. Frustum of, 37. ratios, 194. Cylinders, Water in, 211. D Danger of increasing heating of bearings, 215. of water hammer, 204. Dangerous heating of bearings, 216. Data for brake horsepower, 199. De Laval turbine, Care of

gears in, 230.

Decimal equivalents of parts

of 1 inch, Table of, 45.

Dead plate, 104.

fractions. 4.

Conversion of temperatures,

viii INDEX

Decimal, Reducing a common fraction to a, 5. to common fraction, а Reducing a, 5. Decimals, Addition of, 4 Division of, 5. Multiplication of, 4. Subtraction of, 4. Delivered horsepower, 191. Denver, Colo., license law, 256. Detroit, Mich., license law. 257. Developed blade area, 234. Diagrams, Taking indicator, 181. Diameter of propeller, Required, 237. Differential pulley, 65. Dimensions of iron boiler tubes, 53. of pipe flanges, 51. of steel boiler tubes, 52. Dirty and gritty oils, 219. Disadvantages of oil fuel, 160. Disk area, 234. Division of decimals, 5. of fractions. 3. of matter, 54. Double-tube injectors, 123. Draft, Measurement of, 108. Production of, 108. required for oil fuel burning, 157. Driven pulleys, 67. Driving pulleys, 67. Dynamometers, 195.

\mathbf{E}

Economy of heating feedwater, 138.

Edges of brasses pinching journal, 218.

Effect of sulphur in oil, 86. of vacuum in turbines, 223.

Effects of clearance, 182.

Elfficiency, Boiler, 144. of engine, Mechanical, 191.

Elements, 54.

Machine, 63.

Table of atomic weight of, 55.

Elgin, Ill., license law, 258.

Ellipse, 36. Engine management, 203. Mechanical efficiency of, 191. out of line, 221. Overloading of, 221. speed and ship speed, Relation between, 243. Starting and stopping compound Corliss, 210. Starting compound slide-valve, 207. Starting condensing slidevalve, 206. Starting non - condensing slide-valve, 205. Starting simple Corliss, 207. Stopping compound slide-valve, 209. Stopping condensing slide-valve, 206. Stopping non-condensing slide-valve, 205. Stopping simple Corliss. 207. with hot bearings, Running, 216. Engineers' license laws, 244. Engines, Causes and remedies for pounding of, 210. of Comparison turbines and, 225. Horsepower of compound, 194. Indicating of, 172. Stating size of, 193. Steam, 172. Steam pipes for, 102. Warming up, 203. Equalizing the boiler feed, 148. Equivalent evaporation, 141. Erosion of turbine blades, Errors of reducing motion, 180. Evaporation, Equivalent, 141. Factor of, 142. Table of factors of, 143. Evaporative power of oil fuel, 86. Evolution, 6.

Excess of air in oil burning, 85. Exhaust - steam feedwater heaters, Types of, 139. -steam turbine, 229. Expanded pitch, Axially, 234. pitch, Radially, 234. Expansion bands, 121. joints, 120. Ratio of, 183. Explosions, Boiler, 170. External boiler inspection, corrosion, 131. heat on bearings, Effects of, Factor of evaporation, 142. Factors of evaporation, Table of, 143. Feeding, Boiler, 123. Feedwater by chemicals, Purification of, 136. by filtration, Purification of, 135. by heat, Purification of, 138. by settlement, Purification of, 135. Economy of heating, 138. heaters, Types of exhaust-steam, 139. Impurities in, 127. Purification of, 135. Testing, 134. Figures, Significant, 6. Filling boilers, 145. Finding horsepower of turbines, 225. the mean effective pressure, 181. Fire, Starting an oil fuel, 155. Firebrick lining of furnaces, Fires, Accidental oil fuel, 158. Banking, 164. Cleaning, 149. in starting, Management of, Precautions in relighting oil fuel, 158.

Fires, Starting, 164. Firing point of fuel oil, 87. with liquid fuels, 150. with solid fuels, 148 Fittings, Boiler, 113. for oil tanks, 153. Furnace, 103. Fixed and movable pulleys. 64.grates, 103. Flanges, Dimensions of pipe, Flash point of fuel oil, 87. Flow of steam, 99. of water in pipes, 72. Velocity of, 72. Foaming, 163. Follower plate, Loose, 212. Foot-pound, 62. Force, Centrifugal, 63. Form of chimney, 109. Formation of scale, 128. of soot with oil fuel, 157. Formulas, 29. Chemical, 55. for slip, 232. Foundations, Chimney, 109. Fraction, Reducing, a decimal to a common, 5. to a decimal, Reducing a common, 5. Fractions, 2. Common, 2. Decimal, 4. Division of, 3. Multiplication of, 3. or mixed numbers, Addi tion of, 3. or mixed numbers, Subtraction of, 3. Friction horsepower, 191. Mixtures for reducing, 215. Frustum of cylinder, 37. of prism, 37. Fuel burner, Shutting down. oil, 158. burning, Draft required for oil, 157. Disadvantages of oil, 160. Evaporative power of oil. fire, Starting an oil, 155.

Fuel fires, Accidental oil, 158. fires, Precautions in relighting oil, 158. Firing with solid, 148. Formation of soot with oil, Furnace, Proportions for oil, 88, Liquid, 82. Objections to gravity feeding of oil, 152. oil, Firing point of, 87. oil, Flash point of, 87. oil, Properties of, 83. Pressure on oil, 152. Separation of water from cil, 154. Specifications for oil, 87. Straining oil, 151. Thermal advantages of oil, 159. Fuels, 79. Calorific value of, 78. Calorific value of oil, 83. Firing with liquid, 150. for steam making, 79. Heating of oil, 152. Solid. 79. Steam and air for atomizing oil, 84. Furnace fittings, 103. Proportions for oil fuel, 88. Furnaces, Firebrick lining of, 88. Fusible plugs, 116. Fusing point, 59. and Fusion vaporization, Table of temperatures and latent heats of, 60. Latent heat of, 59. Temperature of, 59.

G

Gauge and blow-off, Inspection of water, 170.
Connection of steam, 118.
Testing steam, 170.
Gears in De Laval turbine,
Care of, 230.
Goshen, Ind., license law, 260.
Grave bar, Herringbone, 101.
Grates, Fixed, 103.

Grates, Shaking, 105.
Gravity feeding of oil fuel,
Objections to, 152.
Specific, 45.
Gnt in bearings, 220.
Gritty oils, Dirty and, 219.
Grooving, 131.

Head of water, Pressure due to, 72. Heat. 56. in wet steam, 96. Latent, 59. Measurement of, 58. Mechanical equivalent of, of fusion, Latent, 59. Specific, 60. Heaters, Types of exhauststeam feedwater, 139. Heating feedwater, Economy of, 138. of oil fuels, 152. Heats of fusion and vaporization, Table of temperatures and latent, 60. Table of specific, 61. Height of chimney, 110. Helicoidal blade area, 234. Herringbone grate bar, 104. Hints for use of planimeter. Hoboken, N. J., license law, 260. Honeycombing, Pitting or, 131. Horsepower, 62. and revolutions, Relation of, 240. and steam consumption, 191. Brake, 191. Calculating indicated, 192. Calculation of brake, 200. Data for brake, 199. Delivered, 191. Friction, 191. Indicated, 191. Net, 191. of belts, 70.

of compound engines, 194.

INDEX xi

Horsepower of steam turbines, Finding, 225. Standard of boiler, 141. when towing, Reduction of, 240. Hot bearings, 215. Huntington, W. Va., license law, 262. Hydraulics, 73. Hydrostatic boiler test, 169. I Imperfectly fitted brasses. 218. Improper steam distribution. Impurities in feedwater, 127. Incomplete combustion, 78. Incrustation and corrosion, and corrosion, Prevention of, 133. Indicated horsepower, 191. Calculating, horsepower, 192. Indicating engines, 172. Indicator, Attachment of, 175. cord, Attachment of, 180. diagrams, Taking, 181. Inside-spring, 172. Outside-spring, 174. springs, 174. Injection water for jet condenser, 203. Injectors, Advantages and disadvantages of, 127. Automatic, 123. Classification of, 123. Double-tube, 123. Lifting, 123. Location of, 124. Non-lifting, 123. Positive, 123. Size of, 123. Steam supply to, 124. Troubles with, 125. Inside-spring indicator, 172. Inspection, Boiler, 165. External boiler, 165. Internal boiler, 167. of safety valve, 169.

of turbines, 227.

Inspection of water gauge and blow-off, 170. Installation of oil tanks, 154. Insufficient lead, 213. oil, 219. Internal boiler inspection, 167. corrosion, 130. Involution, 6. Iron and steel chimneys, 109. boiler tubes. Dimensions of. Table of weight of round and square, 50. Table of weight of sheet, 48. Irregular areas, 35. Jersey City, N. J., license law, Jet condenser, Injection water for, 203. Joints, Expansion, 120. Edges of brasses Journal, pinching, 218. Journals, Cut brasses and, 218. K

Kansas City, Mo., license law, 265.
Kerosene as a scale remover, 129.
Kinetic energy, 62.

T

Lacing of belts. 72. Lamination, 132. Latent heat, 59. heat of fusion, 59. heat of vaporization, 60. heats of fusion and vaporization, Table of temperatures and, 60. Law, Allegheny, Pa., license, Atlanta, Ga., license, 253. Baltimore, Md., license, Buffalo, N. Y., license, 254. Chicago, Ill., license, 255. Denver, Colo., license, 256. Detroit, Mich., license, 257. xii INDEX

Law, Elgin, Ill., license, 258. Goshen, Ind., license, 260. Hoboken, N. J., license, 260. Huntington, W.Va., license, 262. Jersey City, N. J., license, **263.** Kansas City, Mo., license, 265. Lincoln, Neb., license, 266. Los Angeles, Cal., heense, Massachusetts license, 244. Memphis, Tenn., license, **268**. Milwaukee, Wis., license, Minnesota license, 247. Mobile, Ala., license, 271. Montana license, 248. New Haven, Conn., license, 272. New York, N. Y., license, 273. Niagara Falls, N. Y., license, 275. Ohio license, 249. Omaha, Neb., license, 277. Pennsylvania license, 250. Peoria, Ill., license, 278. Philadelphia, Pa., license, 279. Pittsburg, Pa., license, 280. Rochester, N. Y., license, 280. Santa Barbara, Cal., license, 281. Scranton, Pa., license, 285. Sioux City, Ia., license, 285. Spokane, Wash., license. 286. St. Joseph, Mo., license, St. Louis, Mo., license, 283. Tacoma, Wash., license, Tennessee license, 251. Terre Haute, Ind., license, 288. United States marine engineer's license, 291.

Law, Washington and District of Columbia license, 289. Yonkers, N. Y., license, 289. Laws, Engineers' license, 244. States and cities having license. 244. Lead. Insufficient, 213. Levers, 63. License law, Allegheny, Pa., law, Atlanta, Ga., 252. law, Baltimore, Md., 253. law, Buffalo, N. Y., 254. law, Chicago, Ill., 255. law, Denver, Colo., 256. law, Detroit, Mich., 257. law, Elgin, Ill., 258. law, Goshen, Ind., 260. law, Hoboken, N. J., 260 law, Huntington, W. Va., 262. law, Jersey City, N. J., 263. law, Kansas City, Mo., 265. law, Lincoln, Neb., 266. law, Los Angeles, Cal., 267. law, Massachusetts, 244. law, Memphis, Tenn., 268. law, Milwaukee, Wis., 269. law, Minnesota, 247. law, Mobile, Ala., 271. law, Montana, 248. law, New Haven, Conn.. 272. law, Niagara Falls, N. Y., 275. law, New York, N. Y., 273. law, Ohio, 249. law, Omaha, Neb., 277. law, Pennsylvania, 250. law, Peoria, Ill., 278. law, Philadelphia, Pa., 279. law, Pittsburg, Pa., 280. law, Rochester, N. Y., 280. law, Santa Barbara, Cal., 281. law, Scranton, Pa., 285. law, Sioux City, Ia., 285. law, Spokane, Wash., 286. law, St. Joseph, Mo., 282. law, St. Louis, Mo., 283. law, Tacoma, Wash., 287.

License law, Tennessee, 251. Terre Haute, Ind.. law. 288. law, United States marine engineers', 291. law, Washington and Distriet of Columbia, 289. law, Yonkers, N. Y., 289. laws, Engineers', 244. laws, States and cities having, 214. Lifting injectors, 123. Lignite, 81. Lime, Carbonate of, 127. Sulphate of, 128. Lincoln, Neb., license law, Linear expansion, Coefficients of, 57. measures, 42. Liners, 210. Lining for furnaces, Firebrick, 88. Liquid fuel, 82. fuels, Firing with, 150. measures, 44. Location of oil burners, 151. of injectors, 124. of safety valve, 116. Loose brasses, 210. piston, 211. thrust block, 211. Los Angeles, Cal., license law, 267. Lubrication of turbine bearings. 228.

Machine elements, 63. Magnesium, Chloride of, 128. Maintenance of a uniform steam pressure, 160. of vacuum in turbines, 230. Management, Boiler, 145. Engine, 203. of fires in starting, 146. Marine engineer's license law. United States, 291. Massachusetts license 244. Materials, Weights and sizes of, 45.

Mathematics, 1. Matter, Division of, 54. Organic, 128. Maximum combustion rate of coal, 111. Mean effective pressure, Approximate, 190. effective pressure by ordinates, 187. effective pressure, Finding the, 184. effective pressure, Referred, 195. Measurement of draft, 108. of heat, 58. of pitch, 234. Units of, 42. Measures, Cubic, 42. Linear, 42. Liquid, 44. of angles or arcs, 42. of time, 45. of United States money. of weight, 43. Square, 42. Mechanical efficiency of engine, 191. equivalent of heat, 59. stokers, 105. Mechanics, 62. Memphis, Tenn., license law, 268.Mensuration, 33. Milwaukee, Wis., license law, 269. Minnesota license law, 247. Mixed numbers, Addition of fractions or. 3. numbers. Subtraction fractions or, 3. Mixtures for reducing friction, 215. of oil spray and air, 84. Mobile, Ala., license law, 271. Moisture in steam, 95. Molecular weight, 55.

Money, Measures of United

Movable pulleys, Fixed and,

Montana license law, 248.

States, 44.

64.

xiv INDEX

Mud, Removing, 130. Multiplication of decimals, 4. of fractions, 3.

N

Nature of combustion, 76.

Net horsepower, 191.

New Haven, Conn., license law, 272.

York, N. Y., license law, 273.

Newly fitted bearings, 217.

Niagara Falls, N. Y., license law, 275.

Non-condensing slide-valve engine, Starting, 205.

-condensing slide-valve engine, Stopping, 205.

lifting injectors, 123.

O

Objections to gravity feeding of oil fuel, 152. Ohio license law, 249. Oil, Atomization of, 83. burners, Location of, 151. burning, Excess of air in, Composition of crude, 82. Effect of sulphur in, 86 feed, Stopped, 219. Firing point of fuel, 87 Flash point of fuel, 87. fuel burner, Shutting down, 158. el burning, Draft required for, 157. fuel fuel, Disadvantages of, 160. fuel, Evaporative power of, fuel fire, Starting a, 155. fuel fires, Accidental, 158. fuel fires, Precautions in relighting, 158. fuel, Formation of with, 157. fuel, Furnace proportions for, 88. fuel. Objections to gravity feeding of, 152. fuel, Pressure on, 152.

Oil fuel, Separation of water from, 154. fuel, Specifications for, 87. fuel, Straining, 151. fuel, Thermal advantages of, 159. fuels, Calorific value of, 83. fuels, Heating of, 152. fuels, Steam and air for atomizing, 84. Insufficient, 219. Properties of fuel, 83. ra and air, Mixtures of, sp84y tanks, Construction of, 153. tanks, Fittings for, 153. tanks, Installation of, 154. Oils, Dirty and gritty, 219. of poor quality, 219. squeezed out of bearings, 220. Omaha, Neb., license law, 277. Operation of turbines, 227. Organic matter, 128. Outside-spring indicator, 174. Overfeed stoker, 105. Overheating, 132. Overloading of engine, 221.

Packing, Broken piston, 212. Pantograph reducing motion. 177. Parallelogram, 34. Parallelopiped, 37. Peat, 81. Pendulum reducing motion. 176. Pennsylvania license law, 250. Peoria, Ill., license law, 278. Petroleum, 82. Philadelphia, Pa., license law, 279. Pillow block, Springing or shifting of, 222. Pipe coverings, 121. dimensions, Table of extrastrong wronght-iron, 49. dimensions, Table of standard, 48. flanges, Dimensions of, 51.

materials, 120.

Pipe, Protection of blow-off. 119. Pipes, Flow of water in, 72. for engines, Steam, 102. Piping, Arrangement of, 122. Boiler, 120. Piston, Loose, 211. packing, Broken, 212. speed, 192. striking cylinder heads, 212. Pitch, Axially expanded, 234. Determining the kind of, 236. Measurement of, 234. of propeller, Required, 236. Radially expanded, 234 Pitting or honeycombing, 131. Pittsburg, Pa., license law, 280. Planimeter, 185. Hints for use of, 186. Plate, Dead, 104. Plugs, Fusible, 116. Polygons, 34. Positive injectors, 123. Pounding at crosshead, 213. in air pump, 214. in circulating pump, 214. of engines, Causes and remedies for, 210. Power, Work and, 62. Powering of vessels, 238. Powers, roots, and reciprocals, Table of, 11. Precautions in relighting oil fuel fires, 158. Preparations for shutting down a boiler, 163. Pressure, Approximate mean effective, 190. by ordinates, Mean effective, 187. due to head of water, 73. Finding the mean effective, 184. Oil. 152. on brasses, Reversal of, 213. Referred mean effective, 195. Prevention of incrustation and corrosion, 133. Priming, 162.

Prism, 37. Frustum of, 37. Production of draft, 108. Products of combustion, 76. Projected propeller area, 234. Prony brake, 196. Propeller area, Projected, 234. Required diameter of, 237. Required pitch of, 236. Propellers, Screw, 232. Properties of fuel oil, 83. of steam, 89. Propulsion of vessels, 231. Protection of blow-off pipe. 119. Pulley, Brumbo, 178. Differential, 65. Pulleys, Belt, 66. Combination of, 65. Cooling of brake, 198. Driven, 67. Driving, 67. Fixed and movable, 64. Solid, 66. Split, 66. Wooden, 67. Pump, Pounding in air, 214. Pounding in circulating. 214. Purification of feedwater, 135. of feedwater by chemicals, 136. of feedwater by filtration, of feedwater by heat, 138. of feedwater by settlement, 135. Quality of steam, 95.

${f R}$

Radially expanded pitch, 234. Ratio of expansion, 183. Ratios, Cylinder, 194. Real cut-off, 183. Reciprocals, 10. Table of powers, roots, and,

Rectangle, 34. Reducing a common fraction to a decimal. 5.

xvi INDEX

law, 281.

Saturated steam, 89. Reducing a decimal to a common fraction. 5. Scale, 127. motion, Errors of, 180. Formation of, 128. motion, Pantograph, 177. motion, Pendulum, 176. motions, Slotted-lever, 177. -forming substances their remedies, Table of. 133. wheels, 178. remover. Kerosene as a. 129. Reduction of horsepower when Removing, 130. towing, 240. Scales, Thermometrie, 56. Referred mean effective pres-Scranton, Pa., license law, 285. sure. 195. Screw propellers, 232. Refitting cut bearing, 216. Sector, 35. Relation between engine Segment, 36. speed and ship speed, 243. Semianthracite coal, 80. coal consumption to Semibituminous coal, 80. speed, 242. Separation of water from oil of horsepower and revolufuel, 154. tions, 240. Shaking grates, 105. Remedies for increasing heat-Sheet , Table of weight of, ing of bearings, 215.
for pounding of engines,
Causes and, 210 50ead Shifting of pillow block. Springing or, 222. Removing mud. 130. Ship speed, Relation between scale, 130. engine and, 243. Reversal of pressure on Shutting down a boiler, Prepbrasses, 213. arations for, 163. Revolutions. Relation of down an oil fuel burner, 158. horsepower and, 240. down turbines, 230. Ring, 36. Significant figures, 6. Circular, 37. Signs used in calculations, 1. Rochester, N. Y., license law, Sioux City, Ia., license law, Sizes of chimneys, Table of, Roots, and reciprocals, Table of powers, 11. 112. of engines, Stating, 193. Cube, 6. Square, 6. of injectors, 123. Rope brake, 198. of materials, Weights and, Round and square iron, Table 45. of weight of, 50. Slack follower plate, 212. Slide-valve engine, Starting Rules, Safety-valve, 115. Running engine with compound, 207. -valve engine, Starting conbearings, 216. densing, 206. -valve engine, Starting non-Safety valve, Area of, 115. condensing, 205. Stopping valve, Inspection of, 169. -valve compound, 209. valve, Location of, 116. valve rules, 115. -valve valves, 113. condensing, 206. Sag of belts, 69. Stopping -valve engine. Santa Barbara, Cal., license non-condensing, 205.

Slip, Apparent, 231.

Slip, Formulas for, 232. True, 231. Slotted-lever reducing motions, 177. Sodium, Chloride of, 128. Solid fuel, Firing with, 148. fuels, 79. pulleys, 66. Soot with oil fuel, Formation of, 157. Specific gravity, 45. heat, 60. heats, Table of, 61. Specifications for oil fuel, 87. Speed of belts, 70. of vessels, 238. Piston, 192. Relation between engine and ship, 243. Relation of coal consumption to, 242. Sphere, 37. Split pulleys, 66. Spokane, Wash., license law, Springing of bed plate, 222. or shifting of pillow block, Springs, Indicator, 174. Square iron, Table of weight of round and, 50. measures, 42. roots, 6. Squares, 8. St. Joseph, Mo., license law, Louis, Mo., license law, Standard of boiler horsepower, pipe dimensions, Table of, 48. Starting an oil fuel fire, 155. stopping compound Corliss engine, 210. compound slide-valve engine, 207. condensing slide-valve engine, 206. fires, 164. non-condensing slide-valve Starting simple Corliss engine, 207. turbines, 228. States and cities having license laws, 244. Steam and air for atomizing oi! fuels, 84. boilers, 103. consumption, Horsepower and, 191. consumption of turbines, 223. distribution, Improper, 213. engines, 172. Flow of, 99. gauge, Connection of, 118. gauge, Testing, 170. Heat in wet, 96. Moisture in, 95. pipes for engines, 102. pressure, Maintenance of a uniform, 160. Properties of, 89. Quality of, 95. Saturated, 89. Superheated, 95. supply to injectors, 124. turbines, 223. Steel boiler tubes, Dimensions of. 52. chimneys, Iron and, 109. Stripping of turbine blades, 226. Stoker, Overfeed, 105. Underfeed, 106. Stokers, Mechanical, 105. Stopped oil feed, 219. Stopping compound Corliss engine, Starting and, 210. compound slide-valve engine, 209. condensing slide-valve engine, 206. non-condensing slide-valve engine, 205. simple Corliss engine, 207. Straining oil fuel, 151. Subtraction of decimals, 4. of fractions or mixed numbers. 3. Sulphate of lime, 128. Sulphur in oil, Effect of, 86.

engine, 205.

INDEX xviii

Superheated steam, 95. steam in turbines, 229. Surface condensers, 200. condensers, Cooling water for, 202.

Symbols, Chemical, 55.

T

Table of atomic weights of elements, 55.

of circumferences and areas of circles, 38.

of common names of chemical compounds, 56.

of decimal equivalents of parts of 1 inch, 45.

extra-strong wroughtiron pipe dimensions, 49. of factors of evaporation, 143.

of powers, roots, and reciprocals, 11.

of scale-forming substances and their remedies, 133.

of sizes of chimneys, 112 of specific heats, 61.

of standard pipe dimensions, 48.

of temperatures and latent heats of fusion and vaporization, 60.

of weight of brass and copper tubes, 49.

of weight of round and square iron, 50.

of weight of sheet iron, 48.

of weight of sheet lead, 50.

of weights of various substances, 46.

Tacoma, Wash., license law, 287.

Taking indicator diagrams, 181.

Tanks. Construction of oil, 153.

Fittings for oil, 153. Installation of oil, 154.

Temperature, 56. of fusion, 59. of vaporization, 60. Temperatures and latent heats of fusion and vaporization, Table of, 60.

Conversion of, 57. Tennessee license law, 251. Terre Haute, Ind., license law, 288.

Test, Hydrostatic boiler, 169. Testing feedwater, 134.

steam gauge, 170. Thermal advantages of oil

fuel, 159. unit, British, 58.

Thermometric scales, 56. Thrust block, Loose, 211.

Time, Measures of, 45.

Towing, Reduction of horsepower when, 240.

Trapezium, 34. Trapezoid, 34.

Triangles, 33.

Troubles with injectors, 125. True slip, 231.

Tubes, Dimensions of iron boiler, 53.

Dimensions of steel boiler.

Turbine bearings, Lubrication of, 228.

blades, Clearance of, 225. blades, Erosion of, 226. blades, Stripping of, 226.

Care of gears in De Laval, 230.

Exhaust-steam, 229. troubles, 225.

Turbines, Advantages of, 224. and engines, Comparison

Effect of vacuum in, 223. Finding horsepower of, 225. Inspection of, 227.

Maintenance of vacuum in. 230.

Operation of, 227. Shutting down, 230. Starting, 228.

Steam, 223.

Steam consumption of, 223. Superheated steam in, 229.

Vibration of, 227.

Turbines, Water in, 227. Types of condensers, 200. of exhaust-steam feedwater heaters, 139.

U

Underfeed stoker, 106. Uniform corrosion, 130. Unit, British thermal, 58. United States marine engineer's license law, 291. States money, Measures of,

Units of measurement, 42. Use of zinc in boilers, 134.

${f v}$

Vacuum in turbines, Effect of, 223. in turbines, Maintenance of, 230. Valve, Area of safety, 115. Inspection of boiler safety, 169.

Location of safety, 116. rules, Safety, 113.

Valves, Blow-off cocks and, 119.

Safety, 113.

Vaporization, Latent heat of, 60.

Table of temperatures and latent heats of fusion and, 60.

Temperature of, 60.

Velocity of flow, 74. Vessels, Powering of, 238.

Propulsion of, 231. Speed of, 238.

Vibration of steam turbines, **227**.

\mathbf{w}

Wall, Bridge, 103. Warming up engines, 203. Warped and cracked brasses, 218.

Washington and District of Columbia license law. 289.

Water from oil fuel, Separation of, 154. gauge and blow-off, Inspec-

tion of, 170. hammer, Danger of, 204.

in cylinders, 211. in pipes, Flow of, 72.

in turbines, 227.

Pressure due to head of, 72. Wedge, 37.

Weight, Atomic, 55. Measures of, 43.

Molecular, 55. of sheet iron, Table of, 48. of sheet lead, Table of, 50.

Weights and sizes of materials, 45.

of elements. Table of atomic, 55.

of various substances, Table of, 46.

Wet steam, Heat in, 96.

Wheel and axle, 66.

Wheels, Reducing, 178. Wood, 81.

Wooden pulleys, 67. Work and power, 62.

Yonkers, N. Y., license law, 289.

Z

Zero, Absolute, 57. Zinc in boilers, Use of, 134.